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AIR CORPS NEWS LETTER

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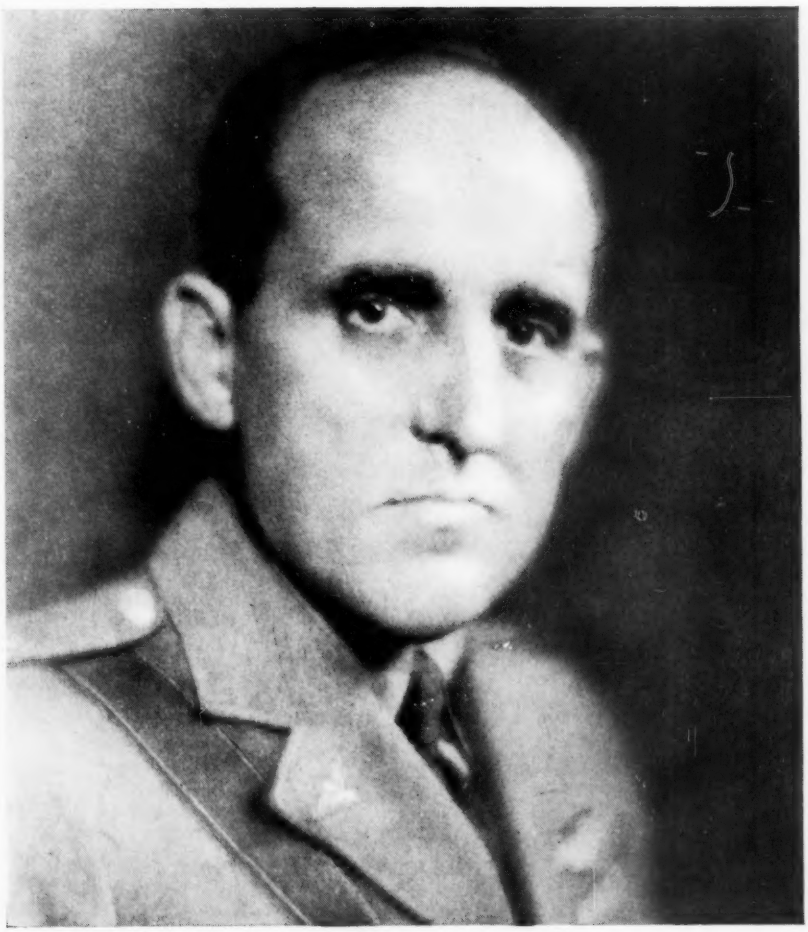
MATERIEL DIVISION NUMBER



THE CHIEF OF DIVISION

VOLUME XX JANUARY 1, 1937 NUMBER 1

Wrote the Chief of the Air Corps to the Chief of the Materiel Division, "Why Not a Feature Materiel Division Edition of the Air Corps News Letter?" * * Responded the Chief of the Materiel Division to the Chief of the Air Corps, "Why Not Indeed?" * * And So, Here It Is! We Hope You Will Like It. * * Next Month's Edition Will Be As Regular As the Revolution of the Earth and All Items From Other Air Corps Fields and Organizations Will Appear As Usual. * * This Number Is Only An "Orphan."

Happy New Year

THE MATERIEL DIVISION extends to each field, department, and office of the Air Corps HEARTIEST GREETINGS and BEST WISHES for 1937. During 1936 the accelerated procurement program for airplanes with accompanying equipment and accessories has held the center of attention. Preparation of circulars, opening of bids, performance testing, and meeting of evaluation boards have marked the months. Development of advanced equipment has for the moment been subordinated to this broader activity which has absorbed all energies of a large engineering and procurement force.

In spite of this concentration on procurement, the necessity for thinking ahead along more advanced technical lines has resulted in the appearance in the various engineering laboratories of some highly interesting projects. At all times the principle has been emphasized that the main reason for the existence of the Division is the service it renders the tactical units of the Air Corps.

Our goal is one which, in accordance with all aviation history, and because of continuing development, ever renews itself.

Again the MATERIEL DIVISION sends forth warm and sincere GREETINGS to all for 1937.

A. W. ROBINS,
Brigadier General,
Air Corps,
Chief of Division.

MATERIEL DIVISION ORGANIZATION

Colonel F L Martin
Executive

Major A W Brock
Asst. Executive

Brigadier General A W Robins, Chief of the Materiel Division, is assisted in his administrative duties by Colonel Frederick L Martin, Executive, who serves also as Commanding Officer of Wright Field, and Major A W Brock, Jr., Assistant Executive, who serves also as Adjutant. Functioning directly under the Chief of Division as Commandant is the Air Corps Engineering School. Functioning under the Chief of Division through the Executive are the Engineering, Field Service, Administration, Procurement, and Industrial War Plans Sections, Army Aeronautical Museum, Flying Branch, the various Post maintenance, service, and supply branches, and the Budget Office; the latter established as a separate organization during 1936 in order to effect a centralized budget control over all Materiel Division activities.

The story of these sections is told elsewhere in the News Letter. There is, however, a definite sequence in the activities of three of them: the Engineering Section is charged with the duty of the development of materiel to a point of standardization where it can be used by the Service. All data concerning the equipment developed are then turned over to the Procurement Section, which prepares circulars and executes contracts for procurement. When procured the equipment is taken over by the Field Service Section for issue to the Tactical Units of the Air Corps.

Under these sections various offices and laboratories operate not only at Wright Field but at other locations.

Working in connection with the Engineering Section is the Aircraft Radio Laboratory at Wright Field, in which two Air Corps officers, six Signal Corps officers, and 80 civilians are employed. Also co-ordinating with the work of the Engineering Section are an Ordnance Officer located in the Armament Branch, and two Corps of Engineers officers in the Aerial Mapping Unit. A Physiological Research Laboratory under

(Continued on page 25)

ENGINEERING SECTION

Lt. Colonel O P Echols
Chief

The ENGINEERING SECTION initiates all experimental work covering the designing, testing, and development of aircraft, engines, accessories, and ground equipment used in connection with the Army aircraft in accordance with an experimental program approved by higher authority. In the many laboratories under the jurisdiction of this Section will be found test equipment representing the most expert judgment obtainable involving an investment of approximately ten million dollars. Not only is this Section responsible for design, development, and testing, however, but also for the preparation of all engineering data used for evaluation and procurement purposes. During the calendar year of 1936 such data formed the basis upon which procurement of the following standard airplanes was accomplished:

PB-2A (Consolidated) biplace pursuit, P-35 (Seversky) pursuit, A-17 (Northrop) attack, O-46A (Douglas) observation, C-33 (Douglas) cargo, B-18 (Douglas) bomber, B-17 (Boeing) bomber, Y1A-8 (Curtiss) attack, BT-9 (North American) basic trainer, BT-8 (Seversky) basic trainer, and PT-13 (Stearman) primary trainer.

The Engineering Section, besides the Administrative Office of the Chief of Engineering, is made up of the Aircraft, Armament, Engineering Procurement, Equipment, Materials, Power Plant, and Shops Branches. The work of all except the Shops Branch is treated separately. Besides routine shop work in connection with equipment, this Branch designs and builds certain necessary items which cannot be procured from the Industry.

Major F O Carroll
Assistant Chief

PROCUREMENT SECTION

Lt. Colonel H A Strauss
Chief, Procurement Section

Lt. Colonel W F Volandt
Assistant Chief

The PROCUREMENT SECTION functions as the procuring agency for practically all equipment and supplies for the Air Corps, which for the Fiscal Year 1937 has involved in excess of sixty million dollars. Of this amount approximately 51.7 per cent is required by the Appropriation Act to be expended for the procurement of new airplanes, complete, approximately 8 per cent for experimental and service test projects, and the remainder of 40.3 per cent for the necessary operating and maintenance supplies.

The organization of the Procurement Section consists of the Contract Administration Branch, Purchase Branch, Inspection Branch, and Legal Branch, which at the present time require seven officers and approximately 260 civilian employees for operation.

The mechanics of procurement are set forth very much in detail by Army Regulations and existing provisions of the law and require essentially the same procedure whether the procurement is in the amount of a few dollars or several million dollars.

The CONTRACT ADMINISTRATION BRANCH serves as a liaison between the contractor and the Contracting Officer, and in carrying out this particular duty secures information as to contractor's plant facilities, resources, finances, personnel, and other pertinent data.

The PURCHASE BRANCH with its two officers (both of whom are empowered to act as Contracting Officers), and approximately 60 civilian employees, is directly responsible for the procedure incident to securing bids, administers the resulting awards and purchase orders or contracts, and follows up the status of such orders or contracts until delivery.

The LEGAL BRANCH is necessary for determination of the great number of legal questions continually arising in connection with making awards or resulting contracts. These questions are the result, in the main, of the

(Continued on page 25)

Field Service Section

Col. F D Lackland
Chief

BETWEEN the experimentation, development, service testing, and quantity purchasing of airplanes, engines, and accessory equipment on the one hand, and the tactical employment of the equipment after it has been turned over to the widely scattered organizations throughout the Air Corps both at home and abroad on the other, there must necessarily be provided a setup to furnish an adequate flow of supplies and spare parts, and a systematic procedure for properly maintaining the equipment.

The administration of this setup is the function of the FIELD SERVICE SECTION of the Materiel Division. In general, this function encompasses the activities of storage, issue, maintenance, salvage and disposal of Air Corps property after it has been standardized for military use; responsibility for preparation of instructions, estimates, schedules, programs, reports, and studies in connection therewith; and administration of the machinery for the overhaul and repair of the equipment.

The system of maintenence is administered through the Air Corps depots, the engineering and supply facilities of which are under the supervision of the Field Service Section. One lighter-than-air and four heavier-than-air depots are maintained in the United States, and one each in the Philippine, Hawaiian, and Panama Departments. Through a system of unsatisfactory reports, augmented by close personal contact between the depots and tactical organizations, all service difficulties are reported to the Field Service Section. It then becomes the function of that Section to initiate whatever action may be necessary for the correction of difficulties. A system is also maintained for issuing all necessary technical instructions covering the maintenance and operation of Air Corps equipment. These instructions are issued in the form of technical orders.

In the administration of the service of supply, a complete system of property accounting is maintained. This system is completely mechanized through the medium of a machine bookkeeping system, all transactions involving property receipts and issues being recorded, with a centralized record showing quantities on hand, location, and current consumption rates maintained in the Field Service Section. Consolidated records of all flying equipment, that is, aircraft, engines, and balloons are also maintained, showing their condition, flying time, and the status and history of each item.

The Field Service Section initiates requests for procurement of Air Corps supplies needed for maintenance of equipment in service; prepares and distributes Air Corps catalogs, Stock Lists, Handbooks of Instruction, and miscellaneous regulations as required; also supervises the loans and transfers of Air Corps property, the disposal of excess and surplus supplies, and the distribution of Air Corps supplies through the depots to National Guard Units.

(Continued on page 25)

INDUSTRIAL WAR PLANS ACTIVITIES

Lt. Col. H V Hopkins
Chief

The INDUSTRIAL WAR PLANS SECTION, under the direct supervision of the Chief of the Materiel Division, is charged with the responsibility of adequate provision for essential wartime needs in the mobilization of Air Corps materiel and the industrial organization incident thereto in accordance with the principles of procurement planning as set forth in the Industrial Mobilization Plan. This responsibility comprises studies with a view to provision for the procuring of stocks of materials, equipment, and supplies in the quantity, quality, and location required, and the assurance that production begins early, that the materiel requirements are supplied as promptly as possible, and that Naval aviation requirements are jointly considered or co-ordinated. In the performance of the mission there is involved liaison with the Office, Chief of Air Corps, Office, Assistant Secretary of War, the Army and Navy Munitions Board, and the Navy Department.

Under the jurisdiction of the Industrial War Plans Section are six Air Corps Procurement Districts, located at New York City; Buffalo, New York; Cleveland, Ohio (now at Wright Field); Detroit, Michigan; Chicago, Illinois; and Los Angeles, California. The officers in charge of these districts are Air Corps Procurement Planning Representatives.

Procurement Plans

Plans for the procurement of basic items, such as airplanes, engines, their component parts and accessories, aerial cameras, special trucks and winches, lighter-than-air equipment, etc., have been made for practically all standard types of Air Corps equipment. The plans contain detailed information regarding the items under discussion, the number required, the sources selected as most suitable to manufacture the article in the quantities required, a statement from each of the selected sources as to the rate of production possible and the percentage of the plant capacity that will be utilized in attaining this production, the estimated unit cost and the cumulative cost for the entire program covering periods of twelve and twenty-four months' requirements, transportation problems involved, and a discussion of any difficulties that might be encountered in the emergency production of the article.

Plans are normally revised every three years, but may be more often, if necessary. When a new type is adopted, it is usually necessary to write an entirely new plan, as the manufacturing phases involved are, in most cases, at variance with those of the former type. The statement from the producer as to his ability to manufacture the item is supported by a factory plan, which is prepared with the aid of the producer, or by the producer himself.

Contributory Items

When the plans for the procurement of the basic items progress

(Continued on page 26)

The Budget Office

The lack of a central agency controlling the preparation of the annual Budget Estimate, the defense of the Estimate before higher authority and the subsequent expenditure of the appropriated funds had, for a long time, resulted in the several sections of

Major B E Meyers
Chief

the Materiel Division functioning as separate and distinct little kingdoms. In February of this year, in appreciation of the paramount need of bringing the financial activities of the Division into a closer knit organization and to permit the exercise of an intelligent budgetary control, there was established in the Materiel Division a Budget Office for the co-ordination and administration of these matters. The task of establishing and operating this very important function was placed in the hands of Major Bennett E. Meyers who has been entitled Budget Officer.

Control over the preparation and administration of the Budget necessarily involves control over the sources of information from which are obtained the data required in the preparation of the Budget Estimate. Thus the Budget Office has jurisdiction over all Material and cost accounting in the Air Corps. This includes control of the method of accounting for property at all Air Corps Activities, the reporting of expenditures and movements of property and the conversion of this information into tabulated statistical data in the Budget Office for use, not only in the preparation of the Budget Estimate but in the procurement and distribution of supplies.

Since the flying of aircraft is the principal function of the Air Corps, it enters into the Budget Estimate as a primary factor. Hence, the recording and reporting of aircraft activity is also a matter necessarily under the control of the Budget Office. The flying data are converted in the Budget Office into statistical information paralleling the expenditure of material and labor and the whole reduced to the statement of material and labor requirement in terms of aircraft activity which is the Budget Estimate.

The use, in the Budget Estimate, of the material and labor consumption data expressed in terms of aircraft activity requires a knowledge of the probable aircraft activity during the period covered by the Estimate. To accomplish this as well as to keep the Chief of Air Corps informed in matters concerned with the future strength of the Air Corps, the Budget Office has established a method of forecasting airplane balances. This involves the establishment of limiting repair costs on airplanes, the limitation being determined by the age of the airplane according to an established depreciation rate.

The magnitude of the work of

(Continued on page 26)

AIRCRAFT BRANCH

Major H Z Bogert
Chief

The AIRCRAFT BRANCH is proud of its position among the aristocracy of aeronautical pioneering organizations. It has given not only many major contributions to aeronautical science but men also to the American industry. Among the former are monocoque airplane construction, dynamically balanced control surfaces, the enclosed cockpit, pressure cabins, and the retractable landing gear. The Branch has also been largely responsible for establishing present-day standards of manufacture and criteria of design.

Among the men drawn from the Aircraft Branch into positions of outstanding importance in the aeronautical world are — Klemin, Monteith, Kindelberger, Cover, and Doolittle. Still serving in the Branch are a number of persons of considerable reputation to whom the Air Corps is indebted for much of its progress. Among these are — P B Smith, D A Dickey, W E Savage, T de Port, J A Roche, and E R Weaver.

The functions and responsibilities of this Branch to the Materiel Division and to the Air Corps are outlined in a book of considerable length, so an extremely brief sketch only is attempted here.

The Aircraft Branch is divided into six major laboratories under the Chief, Major H Z Bogert.

The STRUCTURES DEVELOPMENT AND TEST LABORATORY, under the direction of Captain P H Kemmer, is charged with stress analysis of all aircraft submitted to the Air Corps, testing the structural strength of those purchased, and developing, through test and research, new methods of assembling aircraft structures. To this group, at that time under the direction of Captain C F Greene, the world owes the all-metal monocoque airplane; and through its efforts there is now being constructed the first substratosphere airplane complete with supercharged cabin.

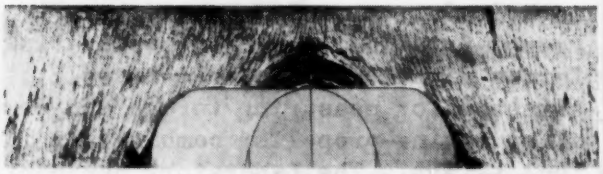
The SPECIAL RESEARCH AND TEST LABORATORY, under Lieutenant R C Wilson, is charged with the preparation of airplane design studies from which military characteristics are established, the preparation of specifications covering the airplane proper, the evaluation of the airplane proper submitted on competition to the Air Corps, and the correction of unsatisfactory design features after the airplane is in service.

This Laboratory is constantly investigating new and novel designs and design details and developing standards wherever they apply. One of its primary functions is the development of projects

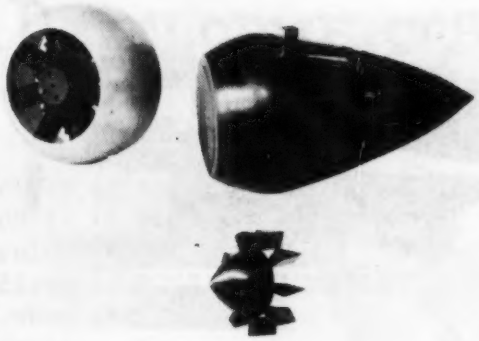
INVESTIGATION OF AIR FLOW

MEASURING DRAG OF COWLING OF AN AIR-COOLED RADIAL ENGINE NACELLE AND THE AMOUNT OF COOLING AIR PASSING THRU

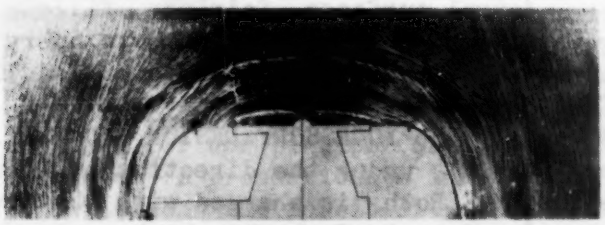
Incidentally the velocities of the air at various points in the propeller disc were measured during these tests, this being the first time this feat has been accomplished.



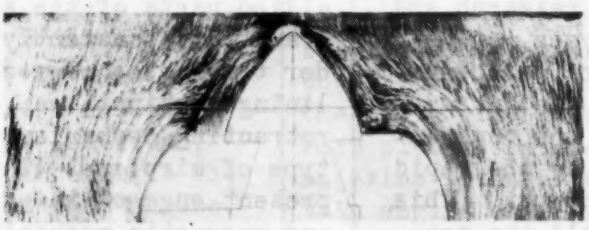
AIR FLOW LINES AROUND AN UNCOWLED AIR-COOLED RADIAL ENGINE AS TESTED IN WRIGHT FIELD 5-FOOT WIND TUNNEL



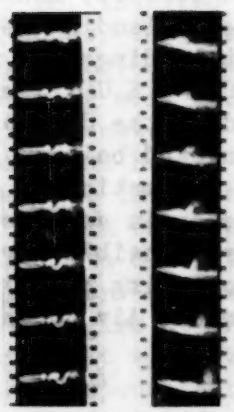
COWL ASSEMBLIES FOR IMPROVING THE COOLING OF AIR-COOLED RADIAL ENGINES ON MULTI-ENGINED AIRPLANES



AIR FLOW LINES AROUND A COMPLETELY COWLED AIR-COOLED RADIAL ENGINE WITHOUT SPINNER

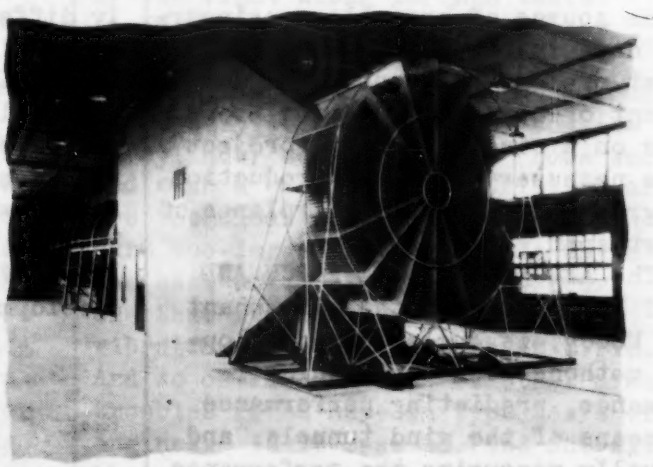


AIR FLOW LINES AROUND A COMPLETELY COWLED ENGINE WITH SPINNER

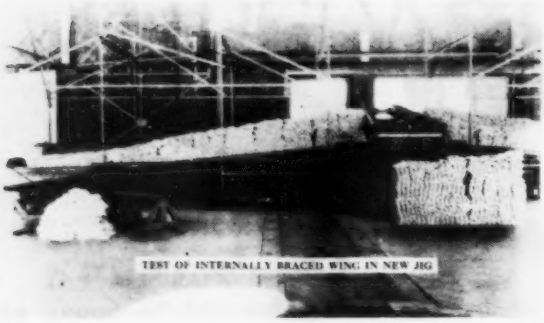


VISUALIZING AIR-FLOW AROUND THICK AIRFOIL SECTIONS USING TITANIUM TETRACHLORIDE PAINTED ON LEADING EDGE

(Test made in 11-inch high-speed wind tunnel)



MATERIEL DIVISION 5-FOOT WIND TUNNEL AS ERECTED AT WRIGHT FIELD



TEST OF INTERNALLY BRACED WING IN NEW JIG

of extremely experimental nature which are usually of secret status.

The PROPELLER RESEARCH AND TEST LABORATORY, under Captain T A Sims, Jr., passes upon the design, and conducts exhaustive tests to determine the characteristics of each type of propeller accepted by the Air Corps. In addition, it is continuously engaged in research and development of new types. The field of its endeavors has been greatly increased by the introduction of controllable and constant speed propellers and by the rapid rise in engine horsepower. This Laboratory conducts all the propeller tests for the Navy and Department of Commerce and is the prime source of propeller engineering data in the United States. It is at present engaged in the development of opposite rotating propellers on a single shaft, a project made necessary by the introduction of great horsepower in airplanes of short span.

The AERODYNAMICS RESEARCH AND TEST LABORATORY, under Lieutenant H M McCoy, is engaged in developing methods of calculating performance, predicting performance by means of the wind tunnels, and actually measuring the performance of an airplane in flight. This Laboratory has made many contributions to the theory of aerodynamics and to the technique of wind tunnel operation. Its latest development is the photographic method of measuring performance in landing and take-off. At present it is engaged in developing methods for measuring static thrust, ground friction, and net accelerating forces of actual airplanes as well as a method for measuring torque and thrust of an engine-propeller combination in actual flight. The Laboratory has contributed much to the establishment of criteria for aerodynamic shapes, such as control surfaces, fairings, fillets, and the like, and for this purpose operates two wind tunnels of 265 m.p.h. and 500 m.p.h. velocity, respectively.

The ACCESSORY DESIGN AND TEST LABORATORY, under the direction of Lieutenant M S Roth, is charged with the development and test of wheels, brakes, tires and tubes, landing gear complete with retracting mechanism, skis, floats, hulls, and allied parts of the airplane. Wheels and brakes are constantly being tested in order to produce correct drum and brake lining combinations; and oleo legs and retracting mechanisms are tested for each type of airplane. This Laboratory is at present engaged in perfecting hydraulic and pneumatic mechanisms for use on aircraft, a new type to replace the streamlined type now in service, and a radically different type of landing gear designed for instrument landings and take-offs.

The LIGHTER-THAN-AIR UNIT, under P B Smith, is engaged in the development of Air Corps balloons and balloon accessories, and in the correction of design faults which develop in service. This Unit is largely responsible for the TC-13 and is now projecting plans for the development of future Air Corps types.

Power Plant Developments

Major E R Page
Chief

The chief function of the POWER PLANT BRANCH is to keep the propeller turning. Without any lengthy discussion, we all know that when the propeller stops everything else stops. Years ago, in the days of iron men and wooden ships and poor engines, forced landings were frequent and, thanks to slow airplanes, a cow pasture usually sufficed. Today most cow pastures are not quite large enough for our high performance airplanes, especially if loaded. A proportionate increase in engine reliability now lessens the possibility of that awakening clatter, that sputter, that puff of smoke, that splatter of oil, followed by that awful silence as you start gliding down to a forced landing, or a jump if old terra firma under you does not look so good.

Next time you start across the Rockies, Hell's Half Acre in West Texas, or the swamps of Louisiana, give a few moments of thought to the years of development of that engine. No one man, no one company, no one organization can take full credit. Engines were not invented over night from bright ideas; they have been developed over a period of years by hard, painstaking work and, incidentally, at great cost.

The Power Plant Branch has contributed its share to the development and research of modern engines and accessory gadgets. Its chief concern is to give to the service the best, the most reliable engine at the earliest possible date. It works in conjunction with the various manufacturers who produce the finished product for test. The test consists of running the engine at various speeds and power loadings with controlled temperatures and pressures, simulating standard sea level conditions and the various conditions at altitudes. Contrary to the optimistic manufacturer and the rosy picture painted in an aviation magazine article featuring that certain engine used in a sporty racer in a record-breaking dash across the country — engines don't usually breeze right along through tests.

In the Power Plant Branch they must prove themselves capable of routine, day-to-day, for continued military service. Does number so-and-so cylinder cool properly? Does such and such a bearing get sufficient oil? Are the clearances on such and such a part too large or too small? Why did the case crack after so many hours on the test stand? Why the excessive vibration at such and such an r.p.m.? And so on for hundreds of other minor troubles found here in type tests of engines. Is it best to find out all those troubles on the test stand or over the Alleghenies, ceiling zero?

The first article of any experimental engine development is subjected to a 50-hour Development Test, following which any changes found necessary as a result of this test are incorporated. The engine is then subjected to a Type Test of 150 hours' duration. The successful completion of this test establishes the engine as an Air Corps type. Each model of each type of engine is subjected to this Type Test before it is assigned an Air Corps model designation and considered satisfactory for use in military aircraft. The duration and severity of this type test usually brings out the major troubles in any model engine, although the Service Test of the engine will undoubtedly reveal further troubles of a nature likely to be encountered in service. If the engine possesses unusual military value, it is a year or more before release is granted for use on commercial air lines or for export to foreign countries. Close liaison with commercial air lines offers a trade of ideas for mutual benefit.

Quoting from a recent report, the "Power Plant Branch activities during the past fiscal year have been concentrated on increasing the power output of engines in service, development of new types of engines, improved fuels to permit greater power output and lower fuel consumption, an extension of supercharging to higher powers and altitudes, and the development of an oil dilution system for cold weather starting. Considerable progress has been made in the development of engine accessories, such as vacuum pumps, long reach spark plugs, magnetos and shielding, engine-driven gear boxes for accessory drives, hydraulic fuel pump drives, fuel pressure regulators, automatic oil temperature control valves, automatic supercharger regulators, automatic mixture controls, fuel injectors and controls, and hydraulic engine controls," all for the benefit of those who fly. The general trend in engine improvement is to take as much responsibility as possible from the pilot's already crowded mind, by replacing the great mass of control handles and gadgets by foolproof automatic controls, out of sight and, we hope, out of mind.

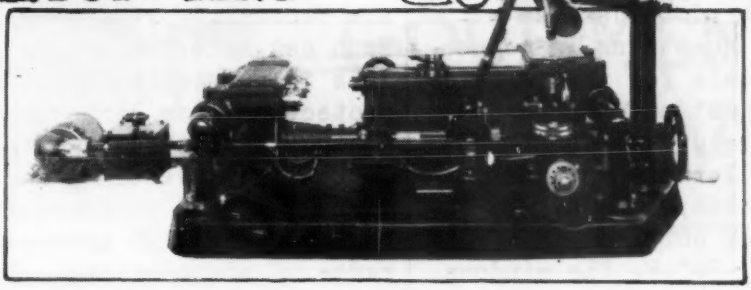
Snow in Summer Time

Recently, a visiting pilot in the Power Plant Branch was quite surprised to see men in winter flying clothes in the hallways of our Dynamometer Laboratory, especially so, as it was well over one hundred in the shade outside. Since some men were working in shirt sleeves and others in winter flying suits, somebody must be wrong. We followed the men in winter flying clothes to the cold room but not into the cold room. After the men had disappeared through the set of double icehouse doors, we peered in through a set of windows. There was snow on the cold-room floor and icicles hung from most of the objects. An engine was installed on a test stand. Even though we were warm it made one shiver to watch the Eskimo-like men at their routine work testing some gadget.

We checked up on this installation and found it quite a glorified ice plant, capable of cooling 185 pounds of air per minute from 100° F. to -55° F. Power required to operate the plant is some 1800 kw. for an 8-hour day. Approximately 20 tons of cooling coils are required, not to mention cork and other insulating material.

And what is all this for? Most airplanes work very well on a sunny summer day. But how about winter time when the mercury is around zero or below? That's the excuse for the cold room. Here has been developed most of our ideas on oil, gas, and starting troubles in cold weather. Even though perfection has not been reached, sound progress has been made. Next time you are at Wright Field try to include the cold room on your Cook's tour.

MATERIALS RESEARCH



J B Johnson
Chief

THE MATERIALS BRANCH combines the functions of a service organization and a research laboratory. In the former capacity, it does a large amount of testing in connection with the Procurement Program of the Air Corps and acts as a control laboratory by preparing specifications and developing and maintaining standards for the testing and inspection of material and processes at the contractors' plants. Research may be divided into two categories, one which determines the applicability for aircraft construction of materials submitted by the Industry to the Materiel Division, and the other which requires the development of a new process or material in which industry may not be interested on account of its limited application.

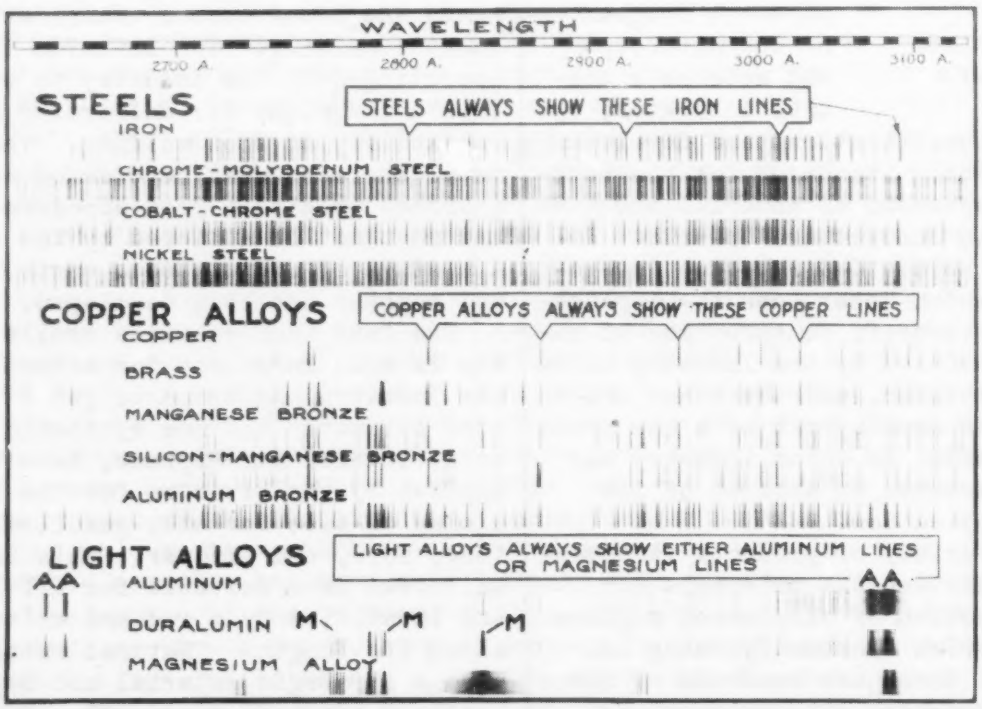
A wide variety of products is covered. Not only are the materials for the construction of airplanes, engines and accessories constantly being improved, but there are hundreds of items used in connection with maintenance such as paper, cleaning rags, sawdust, soaps, and tools for which specifications must be prepared since no other Government agency is interested.

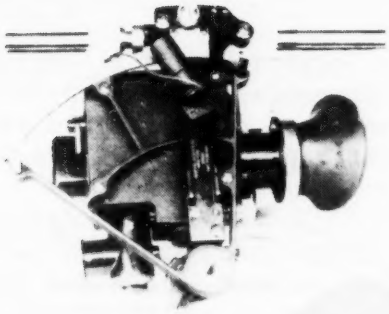
A change in one material or process generally leads to new requirements. The Air Corps has standardized on unpainted metal surfaces for airplanes. An aluminum-coated sheet was selected as the basic material after an exhaustive laboratory investigation of its mechanical properties, corrosion tests in the bay at Chapman Field, and service tests on Army transport airplanes. Spot welding of this material with elimination of the drag from rivet heads and lower cost of fabrication looks promising. The Division is cooperating with the Industry to establish a technique for uniformity and reliability of spot welding. The metal surfaces must be cleaned and polished to give a good appearance, and must not be attacked by the cleaner. A mixture of diatomaceous earth, soap, and naphtha has been developed.

The fact that gasoline swells rubber is well known and for several years the Industry has tried to get a superior product. The new synthetic products, Thiokol and Duprene, have been applied by the Division for the inner lining of hose for oil, gasoline, prestone, dope, and lacquer. This is a universal hose suitable for all liquids and identified by a red and white stripe along its length. Natural rubber is also a strategic material and Duprene has been adapted as a coating for an observation balloon which has been on service test at Fort Sill, Oklahoma for approximately five months, and was used successfully in the summer maneuvers in Michigan and Kentucky.

The probability that airplanes will fly at high altitudes has brought up many questions in connection with materials for this service. The properties must not change at the lower temperatures. Complete properties of all the structural material under static, impact, and vibration are being obtained in a room refrigerated to -50° F. The windows must withstand an internal pressure and it became necessary to obtain the physical properties of glass and glass substitutes. New resinous materials with the transparency of glass but considerably stronger offer a solution of this problem.

In the field of materials competition is very keen and new materials are constantly replacing the older ones. Each new material brings up fresh problems in connection with fabrication, protection from corrosion, as well as a study of its fundamental properties in tension, twisting, and fatigue. To carry out this work requires laboratory equipment of high accuracy and a wide range of adaptability. The laboratory at Wright Field has facilities for determining the presence of the most minute amount of an element in a material by means of its spectrum, or can test to destruction full-size parts for airplanes which may carry a load of 600,000 pounds.





EQUIPMENT BRANCH

The EQUIPMENT BRANCH of the Engineering Section consists of six Laboratories:

Instrument and Navigation
Electrical
Parachute and Clothing
Aerial Photographic - includes Aerial Mapping Unit of Corps of Engineers
Miscellaneous Equipment
Physiological Research

There are approximately 500 items of ground and air equipment for which this Branch is responsible—research, development, and standardization. A brief resume', showing the trend of development is given.

Instrument and Navigation Laboratory

A Douglas C-33 airplane for the conduct of experimental flight tests in connection with the various projects under development has recently been assigned to this laboratory. This airplane has been utilized in testing such devices as improved gyro octants, drift sights and signals, automatic pilots, and navigation computers of various types.

Among the interesting projects now under development is a tachometer that records engine running time. In addition to the pointer which indicates engine r.p.m., two small dials are provided, one to indicate accumulated engine time up to 500 hours, the other to indicate "trip" time. Only the latter counter can be reset from the face of the instrument.

A synchronous control for multi-engine installations has shown promise of early accomplishment. An experimental model of this device has been operating on bench tests and automatically synchronizes speeds much better than can be accomplished by manual control.

Instrument test equipment of a portable nature is nearing completion and it is anticipated the service activities will be supplied with this essential equipment in the early part of the coming year.

Electrical Equipment

Aircraft and ground lighting equipment are keeping pace with the requirements of advanced aircraft and the needs of the latest landing field installations. New equipment under development includes portable-by-air lighting equipment for landing fields.

Electrical development has been characterized by exploration into the field of alternating current for aircraft application. An experimental installation will be made during the present fiscal year.

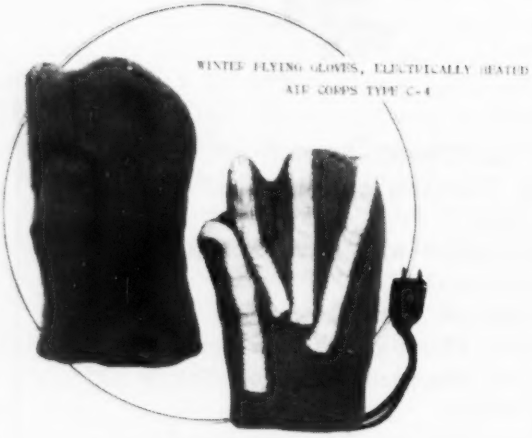
Parachutes and Clothing

Present parachute development is concerned with high-speed opening parachutes for use in the faster military airplanes. Improvements in winter flying clothing are concerned mainly with those changes made necessary by changes in air-

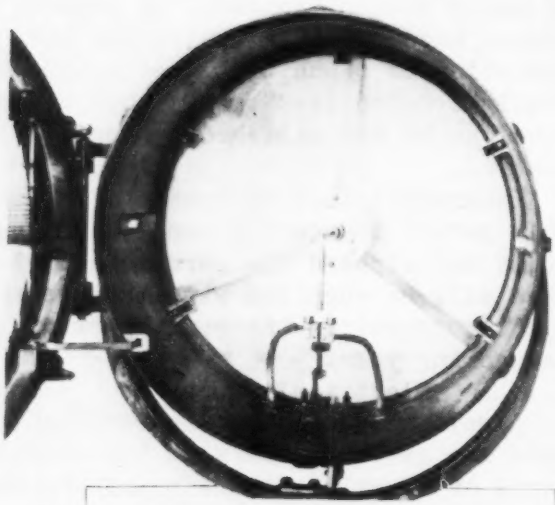
Major F S Borum
Chief

MISCELLANEOUS EQUIPMENT

ANTI-AIRCRAFT HIGH SPEED TOW TARGET
AIR CORPS TYPE I-12

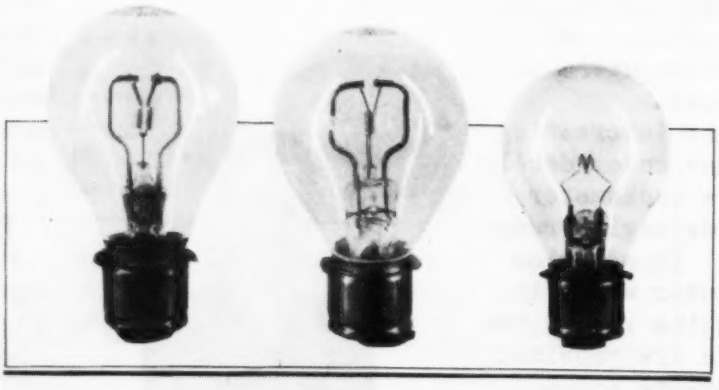


WINTER FLYING GLOVES, ELECTRICALLY HEATED
AIR CORPS TYPE C-4



LAMP GAUGE FOR FOCUSING HEADLIGHT

OXYGEN FACE MASK, AIR CORPS TYPE A-6



COMPARISON OF LANDING LIGHT
LAMP FILAMENTS, AIR CORPS TYPES
C-2, C-8 and CC-2

plane design. A shoulder type safety belt is under development as a means of preventing head injury to the pilot in the event of a crash.

Aerial Photography

A self-contained photographic laboratory automobile trailer unit has been developed having one room completely equipped for printing and one for film processing and print finishing. The Unit houses its own ventilating system, water supply, electric power plant, chemical and material supply, together with all photographic accessories necessary to produce complete mosaics wholly within the Unit.

Miscellaneous Equipment

Progress is being made in the development of steam operated external energizers designed especially for use in cold weather. The equipment consists of a small automatically controlled steam generator weighing about 100 pounds and a steam-driven external energizer.

Physiological Research Laboratory

One of the most interesting projects of this Laboratory is an investigation of the effect of centrifugal force on pilots. The equipment for this research consists of a long rotating arm with a seat bolted to its outer end. Powered by a large electric motor this arm is rotated at speeds up to 80 r.p.m. at which speed a force of twenty times the pull of gravity is developed. Members of the laboratory are acting as experimental subjects up to 8 "G's" and anesthetized experimental animals for the higher forces which may produce permanent or fatal injuries.

—

STRATOSPHERE FLIGHT REPORT

An Engineering Section Memorandum Report on results of the 1935 Stratosphere Flight, prepared during 1936, states that all instruments and apparatus functioned as planned throughout the flight, with the exception of the three-blade 45° pitch propeller at the end of a yardarm, which failed to turn the balloon and gondola about a vertical axis above 62,000 feet because of the extreme thinness of the air. If another stratosphere flight were to be made, the experience of the last two flights indicates that it is possible to carry at least 1,000 pounds of scientific instruments to an altitude 10,000 feet higher than the altitude attained on the last flight.

—

PARACHUTES

The quick-attachable, Type A-2 parachute has been standardized. This parachute is composed of a standard Type S-1 hemispherical canopy attached to a conventional design pack assembly having one point steel coupling means for attachment to the harness. The harness assembly used with the Type A-2 is of the cross webbing cradle design and contains the female member of the steel coupling located below the chest for attachment of the pack assembly. The operation and maintenance of the Type A-2 is identical to the present standard hemispherical types.

—

PELORUS, TYPE A-2

An Engineering Section Memorandum Report states results of experimental tests on the Type A-2 Pelorus,—a mechanical instrument used for taking bearings from an airplane in the air, both celestial and terrestrial. The experimental tests were satisfactory and steps are being taken to procure a quantity for service test.

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Engineering Procurement Branch

Major C F Greene
Chief

The ENGINEERING PROCUREMENT BRANCH was created by the Chief, Engineering Section in May, 1935, to handle the engineering work pertaining to aircraft procurement and in particular to meet the demands of the Accelerated Aircraft Procurement Program then under way. In order to conduct all phases of this work under the close supervision of the Chief of the Section, the following existing agencies were assembled to form the new branch:

Project Officers and Engineers (4 Units); Specifications, including Army-Navy Standards and Army-Navy Commerce Requirements; Drafting & Records.

The Project Officers were transferred from the Aircraft Branch and with civilian Project Engineers formed the following Project Engineering Units: Attack and Observation (Amphibian and Autogiro), with Captain P W Timberlake, Project Officer, and L V Cook, Project Engineer; Bombardment, with Lt. L F Harman, Project Officer, and O H Snyder, Project Engineer; Pursuit, with Lt. B S Kelsey, Project Officer, and J R Austin, Project Engineer; and Training and Transport, with Captain L C Craigie, Project Officer, and R L Montgomery, Project Engineer.

These Units were charged with the duty of assembling and co-ordinating all technical data required for the procurement of complete aircraft. This work includes the preparation of the initial type specification to the final adjustment of deficiencies or changes found necessary during the course of the contract. In the case of a standard procurement, it includes the preparation of Method of Evaluation, the distribution to the technical branches of technical data pertaining to bids, the assembly of records of the Evaluation (Technical) Committee, compilation of entire Evaluation Proceedings including Report of Utility Board, co-ordination and approval of final detail specification and contract (in the case of the winning bidder) and lastly, the co-ordination of engineering releases on shop drawings and the furnishing of decisions on the many details of adjustment incidental to the manufacture in quantity of complex types of airplanes which are being produced in quantity for the first time. This detail adjustment might extend well beyond the delivery of the last airplane of a contract, dependent upon the degree of responsibility of the contractor.

The Project Officer must follow the production of a type from its inception in the form of basic "Military Characteristics" through the above procedure to the delivery of the last airplane. This includes the keeping of a file of data on foreign airplanes of corresponding types as well as data on all

previously constructed domestic aircraft of record to date. It means that the Project Officer conducts a complete specialized engineering office pertaining to the types assigned and is the direct representative of the Chief Engineer on all engineering matters pertaining to those types. He must make visits to the manufacturing plants and to tactical activities operating the airplanes. He must fly demonstration airplanes as soon as they are made available by the Board. In collaboration with the Air Corps Representative at the manufacturer's plant he flies and usually ferries to Wright Field the first or an early article of a contract. He is a member of the Mock-Up Board and an observer of the static test. He watches the inspection and weighing and initiates all orders affecting airplanes which come to Wright Field for demonstration, test, acceptance, or modification.

Under the present procurement system he is obliged to avail himself of every opportunity to fly and to obtain other pilots' comments on the demonstration airplane or the first article of a contract, in order to sandwich as much of a service test into the proceedings as possible prior to the actual establishment of shop production systems and the "freezing" of the type.

During the past calendar year this Branch has handled the procurement engineering work involved in the manufacture of about 1,230 aircraft including three autogiros, These 1,230 airplanes, about one-third of which have been delivered, were of approximately thirty distinct types which could be further broken down into about forty variations. These represented actual manufacturing or rebuilding contracts and did not include the handling of data submitted informally, examination of foreign and racing plane data, and the many special studies, reports, and investigations which were required from time to time for the information of the Chief Engineer or for transmittal to higher authority.

The Specifications Unit prepares, distributes, and keeps on file all procurement specifications used by the Air Corps. In addition, B F Senart, the Unit Chief, is charged with the duty of maintaining all records, conducting all co-ordination within the Division of the immensely useful and growing Army-Navy Standards, and all matters pertaining to Army-Navy Commerce Requirements.

The Drafting and Records Unit, under E C Duval, is charged with the duty of preparing, checking, and distributing all graphic information for the guidance of contractors.

It maintains the Air Corps Standards Book and the Drafting Room Manual. For reproducing drawings for contractors and for distribution to service activities, six blue printing machines are in continuous operation. The output of these machines amounted to about 2,700,000 pieces during the past year. Next year it is estimated that about 3,000,000 prints will be needed.

Throat Microphone

A Board for the evaluation of a new type throat microphone to be used in radio communication convened December 10th at the Materiel Division.

Board members were: Lt. Colonel A H Gilkeson, Langley Field; Capt. A W Marriner, Office, Chief of Air Corps; Capt. T H Baxter, Barksdale Field; and Major Harry Reichelderfer, Capt. F L Ankenbrandt, and Lt. D C Doubleday from Wright Field.

SECTION AND BRANCH CHIEFS

Lt. Col. D. B. Hoylard
CHIEF ADMINISTRATION SECTION

Maj. M. G. Estabrook
CHIEF ENGINEER & SHOPS BRANCH

Maj. J. F. Powell

Maj. H. G. Montgomery

Maj. C. E. Wheeler

Capt. H. G. Woodward

INDUSTRIAL WAR PLANS SECTION

Capt. J. M. McDonnell
INDUSTRIAL WAR PLANS SECTION

Maj. L. L. Beery
STATION TECHNICAL INSPECTOR

Maj. C. J. Baker
SURGEON

Maj. R. C. Bower
QUARTER-MASTER & CONSTR. QUARTER-MASTER

Maj. A. W. Stevens
Equipment Branch

Capt. H. G. Armstrong
Equipment Branch

Capt. G. W. Goddard
Equipment Branch

Captain C. J. Crane
Equipment Branch

Capt. G. V. Holloman
Equipment Branch

Lt. T. L. Thurlow
Equipment Branch

Lt. D. B. White
Equipment Branch

Lt. C. L. Munroe, Jr.
Equipment Branch

Capt. F. G. Irvin
Flying Branch

Capt. S. R. Harris, Jr.
Flying Branch

Capt. C. W. O'Connor
Flying Branch

Capt. G. J. Eppright
Flying Branch

Lt. M. D. Burnside
Armament Branch

Lt. P. E. Shanahan
Armament Branch

Capt. E. T. Kennedy
Purchase Branch

Capt. E. H. Snodgrass
Purchase Branch

Major E. M. Powers
Engineering Section

Capt. P. W. Timberlake
Eng. Proc. Branch

Captain L. C. Craigie
Eng. Proc. Branch

Capt. C. S. Irvine
Engineering Section

Lt. L. F. Harman
Eng. Proc. Branch

Lt. B. S. Kelsey
Eng. Proc. Branch

Capt. P. H. Kenner
Aircraft Branch

Captain T. A. Sims, Jr.
Aircraft Branch

Lt. M. S. Roth
Aircraft Branch

Lt. H. M. McCoy
Aircraft Branch

Capt. A. H. Johnson
Power Plant Branch

Capt. C. A. Bassett
Power Plant Branch

Capt. F. D. Klein
Power Plant Branch

Lt. G. F. Smith
Power Plant Branch

Lt. P. H. Robey
Power Plant Branch

Lt. J. W. Sessums, Jr.
Power Plant Branch

Capt. A. H. Schwichtenberg
Assistant Surgeon

Major C. M. Cummings
Aircraft Radio Laboratory

Lt. D. C. Doubleday
Aircraft Radio Laboratory

Capt. A. A. Kessler, Jr.
Field Service Section

Lt. W. T. Hefley
Field Service Section

Lt. J. L. Jackson
Field Service Section

Lt. E. W. Rawlings
Field Service Section

Major A. M. Shearer
Aircraft Radio Laboratory

Major H. Reichelderfer
Aircraft Radio Laboratory

Major E. E. Petzing
Aircraft Radio Laboratory

Captain W. T. Guest
Aircraft Radio Laboratory

Captain B. Stern
Meterologist

Capt. F. L. Ankenbrandt
Aircraft Radio Laboratory

Lt. E. H. Beebe

Capt. J. G. Moore

Capt. R. E. Culbertson

Air Corps Engineering School

Lt. H. G. Bunker

Lt. D. J. Keirn

Lt. T. B. McDonald

Lt. L. E. Massie

Lt. D. L. Putt

Lt. S. A. Bedetzke

Lt. H. H. Tellman

Capt. J. Hicks

Maj. H. A. Bivens

Lieut. J. Austin

FIELD SERVICE SECTION

Maj. R. W. Propst
CHIEF PURCHASE BRANCH

Capt. F. H. Vanderwerker
CHIEF LEGAL BRANCH

Capt. R. P. Lyman
POST SIGNAL OFFICER

Capt. J. F. Connell
FINANCE OFFICER

Capt. J. A. Madarasz
SUPPLY OFFICER

Capt. T. H. Chapman
CHIEF INSPECTION BRANCH

ARMAMENT BRANCH

Major J A Woodruff, Chief

The ARMAMENT BRANCH is responsible for the development of all items of armament equipment necessary to the complete complement employed in military aircraft, with the exception of those furnished by other Supply Branches of the Army, in which cases the Armament Branch is responsible for the provision of correct installation and proper functioning.

In the execution of these duties, it is necessary to prepare military characteristics applying to those items furnished by other Branches and to conduct actual development work on those armament items for which the Air Corps is responsible. For Air Corps developments, the Armament Branch prepares initial design and procurement data on the basis of existing requirements, and conducts thorough experimental tests prior to the release of data for service test procurement. Service tests of the items determine adoption, rejection, or continued development.

The Branch is also responsible for the preparation of portions of airplane specifications dealing with provisions for armament, and the determination by airplane inspections of contractor's compliance with such requirements.

Continued development or revisions in design of approved equipment, for the purpose of eliminating unsatisfactory conditions reported by the Service, is also a duty.

The following represents an interesting list of nonconfidential armament projects:

Determination of limiting dimensional characteristics and other installation conditions for turrets or inclosed cockpits in which flexibly mounted guns are used.

Revisions in design of existing bomb racks and control mechanisms for the purpose of incorporating a unit by means of which bombs may be released at regular time intervals, thus producing a controllable spacing on the ground of bombs successively released.

Investigation of revisions necessary in fixed gun installations to increase the number of bullets that can be fired against an objective within a given time interval for the purpose of compensating for the increased ground speed of modern attack type airplanes.

Installation for experimental test of 37 mm. cannon in the nose of the twin-engine attack airplane.

"To my way of thinking—and the observation is based on first hand experience as a correspondent in Europe in 1914 and again in 1917-18—that nation which is best equipped in the aviation arm has provided itself with the surest possible guaranty of peace for the future. If we hold the air, the earth and the sea and the coast lines will be protected."

—Irvin S Cobb

Activities of the Engineer Detachment

Captain L J Rumaggi, Chief

Captain B B Talley

This DETACHMENT, consisting of two officers, five civilian employees, and five enlisted men, is concerned with the development of rapid and economical map-making methods. In all projects, photographs obtained with Air Corps cameras of both single and multiple-lens types, supply the basic topographic information.

Two general methods are employed in transforming the topographic information contained in the photographs into map data. Graphical methods, (radial line triangulation) principally are followed in compiling all planimetric maps (those on which no relief is delineated). In topographic maps, (those showing relief) stereoscopic methods and machines are used. The Detachment is equipped with an aerocartograph and three different types of multiplex aeroprojectors. Both these appliances permit the operator to draw topographic maps direct from information contained in the individual photographs. In the aerocartograph, transparent positive plates, like in size to the aerial negative, are used and in the multiplex projector small transparent positive reductions of the aerial negatives are employed.

With this equipment the Detachment has completed within the past year two of the regulation fifteen-minute quadrangle map sheets of portions of the Olympic peninsula in Washington, five reservoir sites along a proposed Lake Erie-Ohio River canal, and in addition carried out an experimental program of military mapping of Fort Bragg military reservation.

Because the basic information is obtained from aerial photographs the Engineer Detachment assists the Aerial Photographic Unit in tests of new or experimental types of cameras and accessories. The Detachment assisted the Air Corps in photography with tandem five-lens cameras for the Second Army maneuvers of this past summer and those of the Fourth Army to take place next year. In addition, the nine-lens camera of the Coast Survey is being tested.

FRANKIE AND JOHNNY

According to Hoyle, air is made up of a proportion of gases including some oxygen, some hydrogen, some nitrogen, and a few other minor and lesser elements. Suppose we take a couple of particles of air drifting lazily along with the breeze. Let's call them Frankie and Johnny, Pete and Repeat, Amos and Andy, or what have you!

For the sake of conversation Frankie asks Johnny what that fast-moving thing is coming up in the distance. Johnny says, "Why that's a PB-2A — we better duck. I remember getting sucked into a Hiso back in 1919 and I was really battered around."

Before anything could happen — biff! The prop hit them and Frankie allowed as how they were being given the bum's rush at Clancy's dance hall. Before regaining their feet as they bounced along the engine cowling, Frankie had lost the feather from her new hat and Johnny his favorite pipe. Swish, and they whisked through a screen wire netting, down into an intake pipe, and lo and behold — Johnny sees his first turbo-driven impeller. Frankie by this time was suspicious and asked Johnny, "Am I crazy, or is that thing really going round and round?" Johnny did not have time to answer because a blade clipped him from the rear and smacked him on into darkness, down through what he thought must be a crowded sewer pipe terribly cramped for space, and a lot warmer. By the time he had emerged from this long ride he was a little cooler and off in the distance somewhere he heard Frankie giving someone the devil for pushing her around. Fate bounced them together again and Frankie swore that, intercooler or no intercooler, she hadn't been pushed around so much since that subway ride after her last Army-Navy game. Johnny could feel the black and blue places beginning to form but wouldn't admit it to the weaker sex. The crowd wouldn't stop moving. On it went till a hissing noise was heard. Frankie said, "Enough is enough — I don't mind being pushed around in a crowd but that hissing noise sounds like a Bronx cheer from the boys over at the gas house."

Right she was, but it was too late to turn back. This joint had no side exits. A big Swede by the name of Throttle Valve seemed to be the doorman and somehow managed to mix the gas house gang in with the air crowd. About one palooka seemed to be with every fifteen of the air crowd. A flash of light in the distance was an indication to this gang that a party of some kind was about to take place. Frankie snuggled a little closer to Johnny cause she saw by the look in the eye of that guy from the gas house gang that he was in this party for no good. Trouble was brewing!

Another flash and the crowd tumbled down into a deep well whose bottom seemed to fall, give them a shaking up, and then the well suddenly decided to squeeze everybody up to the top. It was as hot and stuffy as the corner pool room. All of a sudden a couple of lightning flashes took place and then hell broke loose. The darkened place immediately made the Chicago fire look small, and was Frankie's face red! Fire was everywhere. A big Irishman flatfoot by the name of Exhaust Valve acted as the bouncer and, without ceremony, kicked the crowd out into a flaming hot alley, and around several corners. By this time everyone was in a mood to smack the first thing

handy. Frankie and Johnny saw a couple of department store revolving doors that turned out to be turbine buckets with a sign on them that said PUSH! They did, and were immediately thrown out into the sunlight again. Johnny was glad that somebody, years ago, had decided that matter could neither be created nor destroyed and explained this to Frankie, but Frankie somehow doubted if she would ever be the same.

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MATERIEL DIVISION ORGANIZATION
(Continued from page 2)

the direction of a Medical Corps officer has been added as a Unit.

Under the jurisdiction of the Field Service Section five main supply depots operate. These are situated at Fairfield, Ohio; Middletown, Pennsylvania; San Antonio, Texas; Belleville, Illinois; Coronado, California.

The Procurement Section controls district inspection offices throughout the United States and has jurisdiction over officers who serve as Air Corps Representatives at aircraft plants.

The Industrial War Plans Section operates six district offices located in New York, Buffalo, Wright Field (Cleveland Office), Detroit, Chicago, and Los Angeles.

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"Transportation and communication are the fundamentals in the economic development of a nation. They are also prime indicators of a nation's ability to meet a national emergency.

The airplane is to transportation of the future, what radio is to communication now and in years to come."

General J G Harbord,
Radio Corporation of America.

PROCUREMENT SECTION
(Continued from page 4)

broad and varied legal rulings which demand strict interpretation.

The INSPECTION BRANCH consists of one officer and approximately fifty civilian employees who are stationed at the Materiel Division for the purpose of controlling and co-ordinating inspection requirements. These requirements also cover by various laws and regulations, applicable not only to supplies sent to the Materiel Division for inspection and acceptance, but also those sent to the Field. This field inspection force consists of six officers who are designated as Air Corps Representatives and are stationed at the airplane contractors' plants, together with approximately 110 civilian employees, some of whom are stationed at airplane and airplane-and-engine factories, the others being scattered throughout the country in strategic points where they may be moved from one city to another in order to make the necessary inspection of supplies as they are contracted for.

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FIELD SERVICE SECTION
(Continued from page 5)

Other functions include the preparation of data for the Budget Office to support annual appropriations; maintenance of liaison with the Office, Chief of Air Corps with respect to depot buildings and grounds projects; maintenance of records of allotment of aircraft to stations; and the necessary control over air transport squadrons assigned to Air Corps depots incident to the proper flow of supplies in the Air Corps.

THE BUDGET OFFICE
(Continued from page 7)

accounting for Air Corps property and recording activity of the aircraft may be seen from the fact that there are annually approximately 1,400,000 postings on Air Corps stock record accounts, and approximately 500,000 airplane flights made. Current Budgets are totaling approximately $60,000,000.

Since the Budget Estimate is prepared nearly two years in advance of the actual expenditure of the funds appropriated, many changes in conditions and equipment inevitably compel readjustment in the setup of funds by project from that originally established in the Budget Estimate. The relative needs of each project and each department concerned are given full consideration but the final decision involving transfer of funds from one project to another obviously can only be made by one individual, who is logically the Budget Officer, who functions in an executive capacity for the Chief of the Division in all Budgetary matters.

Jurisdiction over accounting in the Air Corps includes the auditing of contracts with commercial organizations whereby the Air Corps obtains reasonable assurance of fair return for its expenditures of money.

In brief, the functions of the Budget Office may be roughly divided into two categories: first, the preparation of the Budget including the control of the sources of information required therein; second, the administration of the Budget including the control over the expenditure of the appropriated funds and the auditing of Air Corps contracts incidental thereto.

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INDUSTRIAL WAR PLANS SECTION
(Continued from page 6)

satisfactorily, attention is given to studies for those contributory items and materials which, it is estimated, might be difficult to procure in the time and quantity required. Many raw materials enter into this class of items as well as aircraft hardware, cable, tie rods, valves, springs, crankshafts, machine tools, etc. Among the plans which have already been submitted to the Office, Assistant Secretary of War and approved, are items of permanent mold pistons, tie rods, cordage, engine valves, and valve springs.

Reserve Activities

An important activity of the Industrial War Plans Section is the selection and training of the Reserve Officers necessary to the proper wartime functioning of the Air Corps procurement organization. This wartime organization requires, in addition to the Regular Army and civilian personnel, a total of 477 Reserve Officers, of whom sixty per cent (286), according to the present War Department policy, are selected and trained during peace.

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"The conquest of the air is America's gift to the progress of the twentieth century. We owe it to ourselves to lead the development of aviation both into efficiency and usefulness and also to lead in surrounding this new agency with such moral restraints that nations will agree not to capitalize its destructive possibilities."

—Newton D Baker

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AIRCRAFT RADIO LABORATORY

Colonel J O Mauborgne
Chief

DEVELOPMENT PROGRESS IN THE AIRCRAFT RADIO LABORATORY

Notable among the new equipment being procured are two complete interphone systems, one for two-place, and one for multi-place airplanes; a short-range liaison set, the SCR-238, which will replace both the SCR-134 and SCR-185 sets; and an improved long-range liaison set (SCR-187-A) which will be used in place of the present SCR-187 set in new aircraft. One of the most interesting, as well as important items of equipment recently developed, is the throat microphone, now being procured to replace the T-17 hand microphone. This microphone will fill a long-felt want for use at high altitudes and will allow the pilot or operator free use of his hands for other purposes while operating his radio equipment. While development work of direct current communication equipment may be said to be completed, improvements are continuously being investigated and adopted, where advisable. In line with the projected use of alternating current power supply in large aircraft, alternating current transmitting and receiving equipment for both 800- and 360-cycle current have been developed with a view to determining the trend of such equipment for future use.

In the Air Navigation field, development work has continued on the problem of furnishing a satisfactory radio compass, and with this end in view, two models have been procured. The SCR-AA-186 and SCR-AB-186 sets, which are modifications of the old Type E-4 and differ only in the type of receiver furnished, have already been delivered to the Service, while the SCR-242, which combines the best principles of the art known today, will be available for delivery during the spring of 1937. Work is being carried on to further improve this equipment by furnishing smaller loops in streamline housings, if it proves practicable. Progress has been made in the development of a simple, light-weight direction finder or homing device which can be installed in pursuit airplanes. Tests of a loop wound around the engine cowl have given great promise.

The equipment contained in instru-

ment landing trucks has been improved from time to time, and at present, development work is being pushed to revamp the major portion of this equipment. New marker beacon projector and receptor equipment have already been service tested and are ready for procurement as needed.

A radio range marker for indicating the position of radio range stations provides a more positive indication than the cone of silence and will operate the present type of marker beacon receptor.

Several interesting problems, such as the control of the direction of flight by means of a radio compass and an automatic pilot, and the automatic selection of frequency settings on the radio compass by the action of the marker beacon receptor have reached laboratory solutions, and with slight modifications in the present laboratory designs, should be ready for procurement shortly, if needed.

In this same connection, aid was given the Instrument and Navigation Unit in the development of a training device to be installed in airplanes to simulate blind landing procedure.

The foregoing developments indicate that it will be but a short time until all airplanes will be equipped with efficient and satisfactory radio equipment for all purposes.

Other interesting problems too numerous to mention here, including ultra high-frequency work, are being carried on or will be set up in the development program for the next few years.

T W A "Overweather" Plane

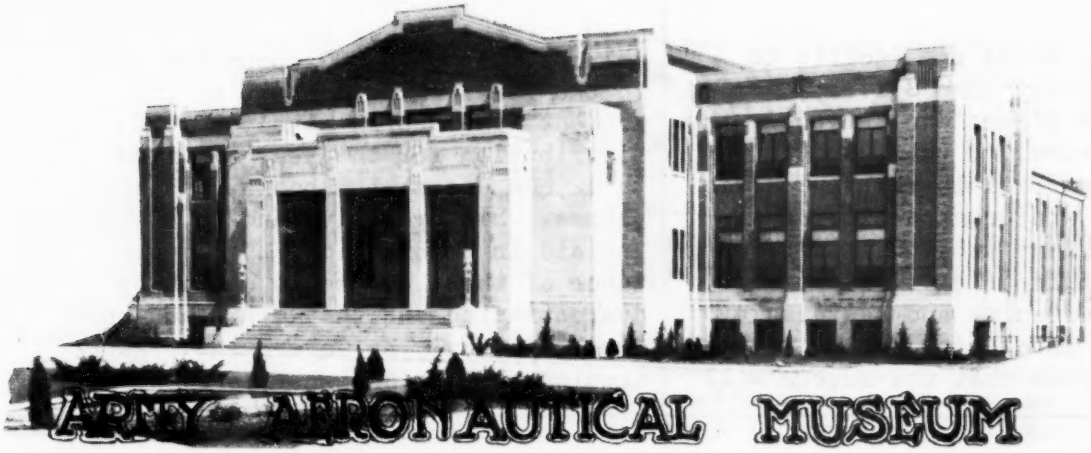
D W Tomlinson and James Hiestand of T W A, Inc., arrived at Wright Field on December 8th in a Northrop fitted up as a flying laboratory for the purpose of engaging with the officers and engineers of Wright Field in experimental substratosphere work. The Materiel Division has been following such a project for some time, convinced that both for commercial and military purposes it will prove a most important development. It is anticipated that they will remain some time at the Materiel Division to complete the testing they have planned.

In flying to Dayton, Tomlinson's average speed from Kansas City in a climb to Columbia, Missouri, was 170 m.p.h.; from Columbia to St. Louis it was 247 m.p.h.; and from St. Louis to Indianapolis it was 251 m.p.h. Between Indianapolis and Dayton, where a descent was made from 30,000 feet, the average was but 213 m.p.h. because of hindering head winds.

W A Reeves, turbo-supercharger expert of General Electric Company, accompanied Tomlinson and Hiestand.

Kellett Autogiro

After a series of tests performed at the Materiel Division the Kellett autogiro was flown to Fort Sill, Oklahoma, by Lieutenant Nichols where it will be used in experimental work in connection with spotting artillery fire.



Although the ARMY AERONAUTICAL MUSEUM Building has housed the Museum, Technical Data Units, and Air Corps Engineering School for more than a year, personnel still enjoy its newness and beauty. It is, in fact, a satisfaction not only to those at Wright Field, but to an average of 140 visitors a day, to whom it is one of the principal points of interest on a tour of the Materiel Division.

Major W J Hanlon is the Director of the Museum and Chief of the various units which function under the Technical Data Branch. This Branch consists of the Library, Editorial, Motion Picture, Photographic, and Statistical Units.

Major W J Hanlon
Chief

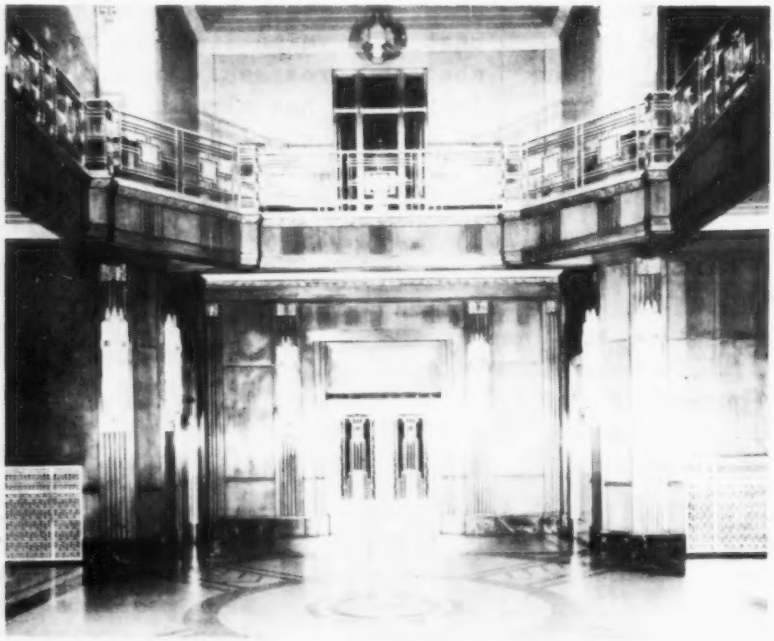
Museum

The main Exhibits Hall measures 115 by 141 feet and contains thousands of items gathered through the life of the Air Corps and collected through the past seven years at the Materiel Division for museum purposes. When the sun streams warmly through the high windows and skylights, it seems to show, not items belonging to a quaint past, but valid links in a triumphant chain of progress. Patent seekers may learn what has already been accomplished along their lines, designers may compare contemplated details with what has gone before, and students may visualize the many amazing engineering strides taken in the brief life of the airplane.

We cannot attempt to name even groups of exhibits. In the spring, suitable items were prepared for the Government display at the Great Lakes Exposition at Cleveland. Among these were modern sectionalized aircraft engines, latest military aircraft types (full-size and models), aerial photographic equipment, modern and obsolete aircraft parts, flying clothing, the propeller of the first military airplane, motion pictures presenting Air Corps activities, both current and historical. This display attracted 2,800,000 clocked visitors in four months.

Among interesting exhibits acquired during 1936 are the command DH-4 piloted by Captain St. Clair Streett in the Alaskan flight of 1920; the Bird of Paradise (Fokker monoplane), first

airplane to cross the Pacific to Hawaii; "Stumpy John Silver," World War carrier pigeon who served in the trenches, survived them, and concluded a comfortable veteran's life in Hawaii; a diorama depicting an airplane making a blind landing on a strange landing field. Improved methods of display and new display cases came into being during the year. It is believed that the Museum will increasingly become a Mecca for the aeronautically minded who will find in it information of interest and value.



Museum Rotunda

Materiel Division Library

Wright Field officers and civilian engineers haunt this pleasant room for purposes of reading, study, and research. During 1935, approximately 400 technical volumes were added to the 8,000 already on the shelves. The capacity is 32,000 volumes. About 3,000 ducuments came to the files which contain at the present time approximately 60,000. Distribution for the year amounted to 12,400 documents, books, and magazines. Historically, and as a working aid in aeronautics, the importance of these documents cannot be overestimated and they are drawn upon freely not only by Government organizations but by designers and engineers of the Industry. Preserved in a fire and burglarproof room, they tell the story of airplane development in their detailed accounts of experiments and tests.

Editorial Unit

The outstanding accomplishment of this Unit for 1936 was the editing, compiling, and publication of a completely new edition (the Eighth) of the Handbook of Instructions for Airplane Designers, a two-volume document

8-1/2 by 11 inches in size, containing 560 pages and 233 illustrations. This book forms a basis of 1938 airplane procurement. Besides this, the Technical Data Digest, a 48-page mimeographed magazine, giving abstracts of aeronautical articles from current publications, was published twice each month. Forty translations from French and German, consisting of from 3 to 34 pages in length, were made. Daily press contacts, preparation of special news and feature articles, lecture arrangements and preparation of lecture data, and Air Corps News Letter contributions were also among the projects of this Unit.

Photographic Unit

This Unit covers the general ground photographic assignments incident to the duties of a large experimental establishment. These include portraits of military personnel, of important experimental projects, and of all new airplanes. Lantern slides, photostats, photographic enlargements, and opal transparencies of late airplanes to be used in display cabinets were also made. During 1936 approximately 24,000 photostats and 19,000 prints were turned out.

Motion Picture Unit

This Unit takes motion pictures and prepares them for historical, technical, training, record, and educational purposes. Sound recording has formed part of this program for the past year and a half.

There is a definite need for motion picture equipment in the Air Corps. No better means of instruction by illustration, for instance, of the operation of an air unit engaged in a mission of attack, from airdrome to objective and return, can be visualized than with the sound motion picture. The utilization of the so-called animated cartoon may also have application. There is also need for motion picture photography in the study of behavior and causes of failure of materiel. Slow motion picture studies of wing flutter, propeller vibration, bomb release mechanisms, and many other aeronautical research problems are considered extremely valuable.

Sound recording is being added to instructional film on the inspection of the A-17 airplane, the photography of which was accomplished at Chanute Field. Approximately 12,000 ft. of film was copied during 1936 for the Office, Chief of Air Corps.

Statistical Unit

One of the most important functions of this Unit is the compilation of charts and data presenting the characteristics of aviation engines and airplanes, foreign and domestic, military and commercial, in order that this information may be disseminated properly throughout the Service. Other charts, photographic layouts, special maps, and drawings are also prepared for various purposes.

This Unit keeps on file the originals of Air Corps Technical, Service, Translation, and other Reports for reproduction, and also distributes them. By the collection of newspaper clippings and general statistical data this office serves as a source of general statistical information to the Materiel Division. Distribution of the Handbook of Instructions for Airplane Designers with revisions, Air Corps Information Circulars, Air Corps and Navy News Letters, and Miscellaneous Naval Reports received from Washington are distributed. Much of the information received in this Unit is of confidential nature and must be accordingly guarded.

ENGINEERING SCHOOL

Lt. R P Swofford, Jr.
Assistant Commandant

The Air School of Application, later designated the AIR CORPS ENGINEERING SCHOOL, was established in November, 1919. This School was the result of the growing realization of the need for a group of Air Corps officers well grounded in aeronautical engineering. A total of one-hundred and eighty-eight officers will have completed the course of instruction with the graduation of the 1936-37 class.

The scope of the curriculum has been changed many times in an effort to keep abreast of the rapid technical progress in Air Corps equipment. It becomes increasingly difficult to cover properly all the essential subjects in the allotted time of one year. It should be remembered, however, that the School is not trying to produce highly trained and specialized engineers in certain particular phases of aeronautical engineering, but to give to officers the sound and general engineering background that will aid them in the performance of duty with the Materiel Division and future service in the Air Corps.

Curriculum

The curriculum may be roughly divided into two parts. Approximately one-half of the time is spent in the study of the fundamental and theoretical engineering subjects such as aerodynamics, airplane stress analysis, propeller theory and design, etc. And one-half is devoted to the practical aspects of engineering as encountered within the Materiel Division proper and the Air Corps Depots. This latter work is performed within the various Materiel Division laboratories, shops, and units, and is under the direction of the highly qualified specialists who are in charge of the various units. This practical work includes such courses as engine laboratory tests, wind tunnel research, flight tests, etc., and stresses Materiel Division procedures, methods, and problems.

A further idea of the scope of the work at the Air Corps Engineering School may be obtained from a general comparison with the five-year course in aeronautical engineering given by any recognized civilian institution. While the theoretical subjects cannot be covered with the degree of thoroughness that is attained in a college or university, yet each professional subject included in the fourth and fifth year in aeronautical engineering at a university is well covered during the year at the Engineering School. Furthermore, in the field of practical engineering the School is in a truly unique position due to its close proximity to the Materiel Division. The laboratory work is performed upon the very latest types of Air Corps equipment and in laboratories equipped for every type and kind of test. The

instructors in this work are experts in their particular fields.

Postgraduate Courses

At the present time three graduates of the Air Corps Engineering School are sent each year to take postgraduate work at certain civilian institutions recognized as outstanding in the fields of aeronautical or power plant engineering. Officers are chosen for this detail from those who desire the postgraduate work and are well qualified to complete it satisfactorily. For these individuals the year at the Air Corps Engineering School furnishes a review of fundamentals, a general background in the entire field of aeronautical engineering, and a familiarity with Air Corps methods and problems that is of inestimable value, both to the officer himself in the pursuit of his work at the university and to the Air Corps in the future work of the officer in his chosen speciality.

Applications

Application to attend the Air Corps Engineering School must be made by letter to The Adjutant General, through channels. The applicant is furnished a questionnaire, which, when completed, gives a synopsis of his service and education. These papers are forwarded to the Faculty Board of the Air Corps Engineering School for recommendation as to whether or not the applicant is eligible for attendance at the School. The minimum technical and educational requirements are that the applicant be a graduate of a recognized technical college, a graduate of the Military or Naval Academy, or that the applicant prove to the satisfaction of the Faculty Board that he has sufficient knowledge of the fundamental sciences of calculus, chemistry, physics, mechanics, and drawing to warrant his attendance at the Engineering School. The class of approximately ten students is detailed each year from the officers upon the eligible list.

Visitors Invited

It is believed that there is comparatively little knowledge among Air Corps officers as a whole as to exactly what is accomplished at the Air Corps Engineering School or the real purpose behind the School. Therefore, this opportunity is chosen to invite any officer who may stop in at Wright or Patterson Fields with an hour or so on his hands, to visit the School, get an idea of what it is all about, and ask any questions concerning the School which he may have in mind.

Anniversary of First Flight

The 33rd anniversary of the first flight was celebrated in Dayton with special significance this year as it marked the inclusion of Dayton on the commercial air map by the inauguration of regular air mail, passenger, and express service for Dayton by both the T W A and American lines.

The usual pilgrimage of the N A C A to the home of Orville Wright and the placing of a wreath on the grave of Wilbur Wright by Brigadier General A W Robins was observed. In the afternoon members of the N A C A visited Wright Field.

Sand from the dunes of Kitty Hawk, North Carolina, where the first airplane took off on December 17, 1903 will be used in christening the new T W A airplane, "City of Dayton." The sand arrived in a bag sewed by Mrs. Tate, wife of Captain Tate of Kitty Hawk who witnessed the first flight, on the same sewing machine used by the Wright Brothers for stitching fabric for their early experiments.

Flying Branch

Capt. S M Umstead
Chief

From the inside, the FLYING BRANCH is a routine workaday affair wherein an airplane is flown to check the r.p.m., manifold pressure, and carburetor ram pressure with a flat wire screen installed in the scoop, or a cooling test as required by E.O. 3759-10 is obtained by the test pilot and observer.

To the outsider it is a laboratory whose roof is the sky, whose walls are all out-of-doors, whose workers are pilots and observers of sound and quick judgment, knowing all that is to be known of the operations of a form of craft still new and radical enough to hold romance.

Actually the Flying Branch is made up of Units of workers as are the other Branches on the field. There are the test pilots headed by Capt. S M Umstead, who is also Branch Chief. The others are Capt. G J Eppright, Capt. S R Harris, Capt. F G Irvin, and Capt. C W O'Connor.

The FLIGHT TEST COMPUTATION UNIT, headed by E L Pratt, designates the method required and the data to be obtained in flight testing of the different airplanes or equipment, and computes results obtained in logical report order.

It also has charge of the installation and calibration of special flight testing equipment and in some cases designs new test instruments to obtain the test information desired. Because of the many new airplanes entered in competitions during the past year, the activities of this Unit have been especially accelerated. There is a PLANES & ENGINES MAINTENANCE UNIT, whose function is to inspect, maintain, and prepare the airplanes in the various hangars for incidental or test flying.

The "OPERATIONS OFFICE" is a self-explanatory term on all airdromes. There is a METEOROLOGICAL OFFICE under Capt. Benjamin Stern of the Signal Corps; and in addition, a RADIO TRANSMITTING AND RECORDING STATION identified by the call letters P E-2 and equipped with a long and a short-wave transmitter. In certain tests this radio is used to obtain flight test data.

Each morning at four, winter and summer, good weather and bad, a pilot goes aloft to 17,000 feet for the

purpose of obtaining weather data, Wright Field being one of a series of stations throughout the country designated for obtaining such information for the U.S. Weather Bureau.

Besides the hangars and those offices at which men work at desks there is a laboratory where special test instruments such as barographs, tachometers, altimeters, air-speed indicators, and thermometers are calibrated before and after test flights; a room for storing equipment temporarily removed from an airplane while special equipment put on in its place is being tested, and where airplane flares are kept handy for night flying; a ballast room, where sand bags, dummy guns, and dummy flares used in weight-carrying tests are ever ready for loading and installing on airplanes under test.

The standard performance test for airplanes has certain basic phases which have not changed greatly during the years. Among them are the power calibration test and calibration of the air-speed indicator, determination of official high speed and operating speed at any altitude, the saw-tooth climb,the check climb, the engine-cooling tests, carbon monoxide tests, the oscillation tests, pilot's preliminary and final observations, and for some airplanes the spinning tests. The latter usually call for anti-spinning devices in the way of releasable ballast or a small parachute attached to the tail of the airplane for the purpose of stopping rotation should the pilot be unable to bring the airplane out of the spin by means of the controls.

None of these tests with the high-powered craft of today is without an element of danger. Therefore, today as always, flight testing of new and experimental engines and airplanes requires courage, cool judgment, and careful, precise flying, all of which qualities are sought in the selection of service pilots for test flying.

During 1936 four initiates entered the Caterpillar Club from the Flying Branch. W W Cummings, H D McDaniels, and John Cutting were ordered to jump from the C-33 on July 22nd, when one of the motors caught fire in the air. Mr. Hobson of Chanute Field and Mr. Wetherford of Middletown Air Depot being in the cabin also jumped. All five men landed safely, as incidentally did the airplane, Captains Frank Irvin and J D Griffith succeeding in extinguishing the flames and bringing the airplane in safely.

Capt. Charles O'Connor was the fifth "Caterpillar" being forced to jump in the cold gray dawn of a weather flight on October 27th near Dayton. The plane went into a spin at 12,000 feet from which it could not be extricated and at 5,500 feet Captain O'Connor took French leave. All will undoubtedly dub it one of their lucky years with the parachute acting as a real Santa Claus.

A seventh Caterpillar initiate was J L Malone, civilian test pilot, who was spin-testing a plane entered at Wright Field for consideration as a trainer. He jumped near the Field at 800 feet when the airplane could not be brought out of a spin.

The flying field at Wright Field is well adapted for flight test purposes. It is generally triangular in shape, covers 520 acres, and has a landing area approximately one mile each way. Three hangars of concrete and steel construction have a total capacity for 75 airplanes.

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MAINTENANCE BRANCH

Lt. Colonel F W Wright

The present MAINTENANCE BUILDINGS AND GROUNDS BRANCH of the Materiel Division was organized during the World War at McCook Field and was known as the Construction Department. After hostilities ceased and McCook Field became the Engineering Division, the Construction Department acquired the title it now holds.

In 1923, it was decided that the Engineering Division had outgrown its quarters both in landing field area and building floor space. As a result the Architectural Unit and the Maintenance Buildings and Grounds Branch in co-operation with Lt. Colonel Frank W. Wright, at that time Chief of Buildings and Grounds of the Air Service, and the Dayton Air Service Committee, which was organized for the purpose, promoted the relocation of the Engineering Division by the use of charts, graphs, a large relief map, and photographs. Shortly after the War Department accepted the new location for the Engineering Division (now the Materiel Division, Wright Field), the Maintenance Buildings and Grounds Branch was allotted the first increment of funds to begin the preparation of the site.

In the spring of 1926, the removal of fences, trees, and other obstructions, and the rough grading of the landing field were started. Several caterpillar tractors and wheeled scrapers were acquired and these were made up into trains with which to move the dirt.

The preliminary layouts of the Field as well as the designs for the buildings had been prepared by the Maintenance Branch, Architectural Unit, and turned over to the Quartermaster General.

Throughout the course of construction, it was the function of the Maintenance Buildings and Grounds Branch, in order to co-ordinate the activities of the various branches with the Constructing Quartermaster to insure that Materiel Division requirements were met.

A majority of the buildings were contracted for by the Constructing Quartermaster. The Maintenance and Grounds Branch, however, installed the steel framework of the buildings, constructed from overseas hangar steel, and the utilities.

As the structures took shape, the stupendous task of moving the Engineering Division was delegated to the Maintenance Buildings and Grounds Branch. This was accomplished with a minimum of delay and confusion considering the great variety of equipment handled and the miscellaneous details connected with dismantling and re-establishment of the huge experimental plant. This was effected under the direct supervision of Major (now Lieutenant Colonel) J. H. Rudolph.

After the establishment had been completed, Lt. Colonel Wright was assigned to Wright Field as Chief of Maintenance Buildings and Grounds Branch, and under his direction the

problem of landscaping and beautification of the Post reached definite success.

At the time of his coming, a majority of the buildings were covered with temporary siding and roofs in the form of corrugated iron sheets. Since that period all, with the exception of five, have been changed to permanent coverings.

The decorative entrance to the Field was a design of the Maintenance and Grounds Branch, selected by competition which was also responsible for its construction.

Of the total amount of funds alotted for the construction and re-establishment, the Maintenance Buildings and Grounds Branch has expended approximately $2,000,000 or 30 per cent.

With the advent of the P W A, approximately 600 relief workers were supervised by the personnel of the Maintenance Buildings and Grounds Branch under the direction of Colonel Wright. All manner of projects were accomplished with these workers, including grading of the field, temporary roads, and improvement to grounds in general.

With the allotment of P W A funds three buildings, the Army Aeronautical Museum, Heating Plant Addition, and Static Test Laboratory, were approved for construction. The preliminary drawings and designs were prepared in the Maintenance and turned over to local architects for completion, the coordination between all agencies being handled under Colonel Wright's direction.

The MAINTENANCE BRANCH as now organized includes the Plant Protection Units and contains 141 capable workmen, each skilled in his particular line. The Branch is divided into the following Units: Administrative, Boiler House, Carpenter, Electrical, Fire Protection, Guard Protection, Janitor, Labor, Millwright, Mobile Machine Repair, Painting, Rigger, Sheet Metal, and Steam Fitting.

The duties of this organization are: the maintenance, drainage, and repair of lawns, grounds, roads, walks, and flying fields; supervising of all heating, lighting, power, gas, water, and sewer systems; the maintenance of buildings and installations, other than special technical installations pertaining to the technical work of the Materiel Division; the erection of such buildings as are authorized; inspection of the above to obviate malfunctioning; and the rendering of frequent reports to the Commanding Officer of the condition in which facilities are found. Fire protection, police protection, and janitor service are also functions of this Branch.

Of the 141 employees, forty-seven have served from 15 to 20 years with the Materiel Division, and fifteen have served from 10 to 15 years.

Automatic Pilot School

A class for instruction in the maintenance and operation of the automatic pilot convened on December 2nd with W W Cummings, engineer, of the Equipment Branch as instructor. Enlisted men from Bolling, Patterson, Langley, Mitchel, Selfridge, Kelly, Barksdale, and Wright Fields were in attendance.

Upon the completion of the course, these students will return to their fields to act as instructors to others who work with automatic pilots. The course is a thorough one, including both flying and ground phases of the care and operation of this important equipment.

HONORS AND AWARDS

During 1936 the Materiel Division had reason to be gratified by honors which came to various members of its staff for the performance of deeds of valor, notable flights, or outstanding contributions to science.

Lt. R K Giovannoli received (posthumously) in 1936 the Cheney Award for 1935. His gallant rescue of Major Hill and Leslie Tower who were trapped in a burning bomber is too well known to need recalling. Besides this, for the same acts of bravery, Giovannoli and also Lt.L F Harman, who assisted in the rescue work, were awarded the Soldier's Medal by the War Department.

Capt. H G Armstrong, Medical Corps, in charge of the Physiological Research Laboratory, was awarded the Henry S Wellcome gold medal and a cash prize of $500.00 for the best paper submitted in a contest on "The Importance of Co-ordinating the Military and Naval Medical Services with the Civilian Medical Profession."

Major A W Stevens has received many acknowledgments of merit for his stratosphere flights. Among them in 1936 came the Oak Leaf Cluster, a distinguished flight award given to aviators who have already received the Distinguished Flying Cross.

A handsome bronze plaque, the gift of the Dayton Chamber of Commerce, was also added to this officer's gifts of merit.

Major Hez McClellan, who was killed in flight testing an airplane last May, was awarded the Distinguished Flying Cross (posthumously) in June, 1936 for his part in the 1935 flight of ten Army bombers from Washington to Alaska and return.

Capt. Frank G. Irvin was awarded the Distinguished Flying Cross on December 10th for courage and cool judgment shown in extinguishing the flames which broke out in one motor of a Douglas Transport and bringing the plane to a safe landing on Wright Field after ordering five civilian test observers to jump for their lives. Capt. J S Griffith, who was piloting the airplane with Captain Irvin and assumed all responsibility with him, was similarly awarded. Both were test pilots of the Flying Branch but Captain Griffith was transferred before the presentation of the award.

Captain Irvin is a member of the Caterpillar Club, having entered when he had been a Wright Field test pilot little more than a month. He was initiated when the spring mechanism of an experimental ski installation failed and sent the airplane into an uncontrollable dive. He was injured in landing.

Capt. B B Talley, Engineers Corps, of the Aerial Mapping Unit, received, upon authority granted by special act of Congress, the Nicaraguan Medal of Merit on August 4th. The Nicaraguan government conferred the medal for especially meritorious services to the Republic during the earthquake of 1931. At the time Captain Talley was in charge of an Engineers' Battalion making a survey of the Nicaraguan Canal.

Photographic Lamp Assembly

Action is being taken to standardize the Type C-1 lamp assembly for Air Corps photographic use. It consists of a parabolic reflector which has provisions for carrying either a No. 4 photoflood lamp, or two No. 2 photoflood lamps, mounted on a stand that permits adjustment from 4 to 8 ft. A suitable connecting cord and switch are provided for controlling the light. The carrying case is part of this equipment and houses two complete lamps in a knocked-down condition.

First Synthetic Rubber Balloon Constructed

HE only balloon in the world constructed completely of synthetic rubber is the Army Observation Balloon, Type C-3, which is undergoing service test at Fort Sill, Oklahoma. Completed in April of this year, it represents another of the many answers to research problems which have had their initiation at the Materiel Division.

Rubber being a product procurable only by import, it has been for many years one of the aims of the Materiel Division to obtain for Air Corps use a synthetic compound which would adequately take its place. The Industry was/and dozens of samples tested in scoured the Wright Field laboratories with but indifferent success. After several years a material was discovered which extensive testing proved not only equaled but surpassed the genuine rubber in every essential characteristic. This material was a commercial product known as "Duprene."

Experiments were started immediately in applying the compound to cotton fabric for the purpose of securing an adequate balloon fabric to supplant the genuine rubberized fabric. In the making of balloon fabric two plies of cloth laid at oblique angles are "doubled" or made homegeneous by interposing a layer of rubber. This method was not changed except that the synthetic rubber was substituted for the genuine. Extensive laboratory as well as exposure rack tests were conducted. Samples were exposed for eight months to the weather with monthly examinations to determine degree of depreciation as to strength and gas diffusion characteristics. At the end of eight months a slightly higher tensile strength than before was shown on the testing machine, and the gas escapage, which with rubberized cloth was from 15 to 19 liters per square meter, was but from 1 to 3 liters in 24 hours.

With these amazing results on samples to encourage them, Wright Field engineers determined that it would be well to try out the new fabric in a full-size observation balloon. Developed in conjunction with the Industry about 200 pounds of synthetic rubber compound were required. Even the cement and tape used in seams and for patching are of the same synthetic materials. In balloon structures seams must test out as strong as the fabric itself. Seam tests were carried out at high temperatures, as in the case of rubber, using synthetic cement. It was found that the performance of the seam was the same as that for rubber cement and was equal to the strength of the homogeneous material. This point was proved in testing many samples at elevated temperatures.

When the balloon was constructed, in lieu of a high temperature test, it was inflated with air and exposed to bright sunlight for two days before inflation with hydrogen. Instead of deterioration it was found that the seam strength had increased. In its service testing the C-3 observation balloon has been used in the Second Army Maneuvers in Michigan, been moved about the country otherwise, and shown excellent durability and gas-holding indications.

The life of a balloon constructed of genuine rubber is usually about one year. In the synthetic rubber balloon a definite and worthwhile increase in this period is anticipated.

This development has led to that of an all-purpose synthetic rubber-coated hose which is impervious to the deteriorating qualities of coolants, gasoline, oil, or other chemical solvents,

at any temperature encountered in practice.

When an experimental organization in search of a substitute finds one not only "just as good" but very decidedly better, it is a happy surprise indeed.